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10CFR50.73(a)(2)(iv)(A)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Licensee Event Report Submittal

Enclosed is Licensee Event Report (LER) 2014-004, "Loss of Feedwater Results in Automatic Reactor Protection System Actuation". There are no regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Nicola Conicella, Manager – Regulatory Compliance, at (440) 280-5415.

Sincerely,

Ernest J. Harkness

Enclosure:
LER 2014-004

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE22
NRR

NRC FORM 366 (01-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Perry Nuclear Power Plant	05000-440	1 OF 4

4. TITLE

Loss of Feedwater Results in Automatic Reactor Protection System Actuation

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	Rev NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
10	20	2014	2014	004	00	12	XX	2014	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
99.1	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71 (a)(4)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71 (a)(5)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☒ OTHER
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
David Lockwood – Regulatory Compliance	440-280-5200

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EJ	ECBD	C782	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSSION DATE	MONTH	DAY	YEAR
YES (*If yes, complete 15. EXPECTED SUBMISSION DATE*) NO				

ABSTRACT *(Limit to 1400 spaces i.e, approximately 15 single-spaced typewritten lines)*

On October 20, 2014, at 0217 hours, the reactor protection system (RPS) automatically actuated due to a loss of feedwater flow to the reactor pressure vessel (RPV). There were no complications during the shutdown as all control rods fully inserted and pressure was maintained by normal means. The High Pressure Core Spray (HPCS) and the Reactor Core Isolation Cooling (RCIC) systems actuated based on a valid low reactor water level initiation and injected to restore RPV water level.

The cause of the event was failure of a balance-of-plant static transfer switch, which provides electrical power to the digital feedwater control system. A circuit card in the static transfer switch degraded, which caused a loss of power during manual transfer operations. The electrical loads serviced by the inverter were placed on an alternate power source using the bypass test switch. A design change was completed to provide diverse power sources for the digital feedwater control system availability logic to prevent similar occurrences.

The safety significance of this event is considered to be small. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in an automatic actuation of the RPS, HPCS, and RCIC systems, and Operational Requirements Manual section 7.6.2.1, which requires a Special Report submittal following an Emergency Core Cooling System actuation and injection into the reactor coolant system.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

INTRODUCTION

On October 20, 2014, at 0217 hours, the Reactor Protection System (RPS) [JC] automatically actuated in response to a low reactor water level (i.e., Level 3, 178 inches above the top of active fuel (TAF)) signal due to a loss of feedwater flow to the reactor pressure vessel (RPV). At the time of the event, the plant was in Mode 1 with the reactor operating at 99.1 percent of rated thermal power (RTP). Reactor water level continued to decrease until the High Pressure Core Spray (HPCS) [BG] and the Reactor Core Isolation Cooling (RCIC) [BN] systems automatically started to restore RPV level. At 0355 hours, notification was made to the NRC Operations Center (Reference ENF No. 50551) in accordance with 10 CFR 50.72(b)(2)(iv)(A), emergency core cooling system (ECCS) discharge into the reactor coolant system; 10 CFR 50.72 (b)(2)(iv)(B), actuation of the reactor protection system when the reactor is critical; and 10 CFR 50.72(b)(3)(iv)(A), valid actuation of several specified systems. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in automatic actuation of the RPS, HPCS, RCIC, Division 3 Emergency Diesel Generator (EDG) [EK], Division 3 Emergency Service Water (ESW) [BI], Division 1 ESW, and containment isolation valves [JM].

This report also satisfies the Operational Requirements Manual (ORM) section 7.6.2.1, which requires a Special Report submittal following an ECCS actuation and injection into the reactor coolant system.

EVENT DESCRIPTION

On October 20, 2014, the plant was operating in Mode 1 at 99.1 percent RTP. The plant was in a normal electrical line-up with all EDGs and all ECCS systems operable. The Feedwater System [SJ] was in its normal alignment with turbine-driven reactor feedwater pumps (RFP) A and B in automatic 3-element level control. The motor-driven feedwater pump (MFP) was in standby.

At 0217 hours, an RPS actuation occurred resulting in an automatic reactor scram. The RPS actuated in response to a low reactor water level (Level 3) signal as a result of a loss of feedwater flow to the RPV. The loss of feedwater resulted when the feedwater demand signals were driven to zero based on a loss of power to Digital Feedwater Control System (DFWCS) input signals for determining the availability of feedwater pumps. The MFP started as designed on the RFP trip signal. All control rods fully inserted into the core.

RPV water level continued to decrease to the Level 2 setpoint (130 inches above TAF) where the RCIC and HPCS systems started and injected into the RPV. Containment isolation occurred with isolation of all required valves. Both Reactor Recirculation [AD] pumps tripped as designed. The Division 3 EDG, which supplies emergency electrical power to the HPCS system started but, as designed, did not load onto the bus. At approximately 0221 hours, the HPCS and RCIC systems and the MFP stopped injecting when the Level 8 setpoint (219 inches above the TAF) was reached. The lowest RPV water level reached during the event was 87.1 inches above the TAF. RPS was reset at 0240 hours. Mode 4, Cold Shutdown was entered at 2323 hours, when the average reactor coolant temperature decreased to 200 degrees Fahrenheit.

CAUSE OF EVENT

The RPS scram was caused by an electrical transient in the balance-of-plant (BOP) 120 volt AC Uninterruptable Power Supply (UPS) system [EJ]. At the time of the event plant operators were in the process of shifting the BOP static transfer switch [ASU] to its alternate source for maintenance on the BOP Inverter. The

transient was caused by a degraded static transfer switch component. Alternate supply voltage was available but a static transfer failure resulted in a loss of power to the UPS system loads.

During the subsequent investigation, it was found that the static transfer switch's alternate power silicon controlled rectifiers (SCRs), were not firing due to an issue from the sensing and transfer card [ECBD]. Without the alternate SCRs firing, no voltage would be provided from the alternate source. Laboratory analysis determined that the card had a degraded logic chip. A NAND gate used in the logic chip was degraded. The degraded NAND gate caused a voltage drop resulting in 6.5V at the input to the downstream logic. This was lower than the expected 15V and failed to generate an "on" signal to the downstream logic. This prevented a firing signal being sent to the alternate source's SCRs. Analysis determined the degradation to be the result of a manufacturing defect.

The control logic for the DFWCS is one of the electrical loads serviced by the UPS. Among the loads was an input signal to the RFP availability logic. Disruption of the DFWCS power due to the electrical transient affected the feedwater system causing the control circuit to believe it was not available and drove the output to zero. As a result, feedwater flow was lost to the RPV and the RPS actuated, as designed, when RPV Level 3 was reached.

EVENT ANALYSIS

The UPS provides a highly reliable source of 120 VAC electrical power to specific plant loads. Power to the BOP loads is supplied by a 125V battery and is routed through a distribution bus, an inverter to convert DC to AC power, and a static transfer switch. If the inverter output voltage drops too low, the static transfer switch will transfer to the alternate source. The UPS is not controlled by Technical Specifications and is not essential to safe shutdown functions.

There were no complications during the shutdown as all control rods fully inserted and RPV pressure was maintained by normal means. The RPS functioned as designed.

The scram event, including plant response, is bounded by the Loss of Feedwater Flow transient evaluated in the Updated Safety Analysis Report (USAR) Chapter 15, Accident Analysis, Section 15.2. 7. As a direct result of the scram, no plant parameters challenged the transients as described in the USAR. This transient is categorized as an incident of moderate frequency.

ORM section 7.6.2.1 requires a Special Report be submitted following an ECCS actuation and injection into the reactor coolant system. The report shall include a description of the circumstances of the actuation and the total accumulated actuation cycles to date. The current value of the usage factor for each affected safety injection nozzle shall be provided when its value exceeds 0.70. Following the scram, the HPCS system actuated once for level control and injected into the RPV for approximately 3 minutes. This injection brings the total number of HPCS injections to 44 over the life of the plant. The current design Cumulative Fatigue Usage Factor (CFUF) for the limiting location of the HPCS nozzle is 0.567. The number of design HPCS injections is 60. The number of operating HPCS injections is bounded by the design allowance. The current design CFUF value is less than ORM Special Report Limit (0. 70).

A Probabilistic Risk Assessment (PRA) evaluation was performed for this event. An analysis of this plant trip indicates a delta core damage frequency (CDF) of 1E-08/yr, and a delta large early release frequency (LERF)

of 3E-10/yr. The delta CDF and delta LERF values are well below the acceptable thresholds of 1.0E-06/yr and 1.0E-07/yr, respectively, as discussed in Regulatory Guide 1.174. The risk of this event is therefore considered small in accordance with the Regulatory Guidance.

CORRECTIVE ACTIONS

The electrical loads serviced by the inverter/static transfer switch were placed on the alternate power source using the bypass test switch. An Operational Decision Making Issue (ODMI) evaluation was prepared and approved to operate in this alignment under administrative controls through the next refueling outage (March 2015). The power plant was then restarted with BOP 120 VAC electrical loads aligned to the alternate power supply. The circuit is classified as a Protected Train which prevented further troubleshooting efforts.

A design change was completed to provide diverse power sources for DFWCS availability logic to prevent similar occurrences.

PREVIOUS SIMILAR EVENTS

A review of LERs and the corrective action database for the past three years identified one similar event.

LER 13-001, Loss of Feedwater Results in Automatic Reactor Protection System Actuation, documents a similar event due to an electrical transient in the balance-of-plant 120 volt AC Uninterruptable Power Supply system [EJ]. The cause was identified as inadequate reliability improvement for the UPS.

The corrective actions from this event included replacing the sensing and transfer card. The corrective actions would not have prevented this event as the degradation of the logic chip on the sensing and transfer switch was the result of a manufacturing defect.

COMMITMENTS

There are no regulatory commitments contained in this report. Actions described in this document represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments.